

Constraints on Ξ^- – nuclear interactions from capture events in emulsion

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Five $\Xi^- p \rightarrow \Lambda\Lambda$ two-body capture events in ^{12}C and ^{14}N emulsion nuclei, in which a pair of single- Λ hypernuclei is formed and identified by their weak decay, have been observed in (K^-, K^+) emulsion exposures at KEK and J-PARC. Applying a Ξ^- -nucleus optical potential methodology to study atomic and nuclear transitions, we confirm that these capture events occur from Coulomb assisted $1p_{\Xi^-}$ nuclear states. Long-range ΞN shell-model correlations are found essential to achieve consistency between the ^{12}C and ^{14}N events. The resulting Ξ -nuclear interaction is strongly attractive, with Ξ potential depth in nuclear matter $V_{\Xi} \geq 20$ MeV. Implications to multi-strangeness features of dense matter are outlined.

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